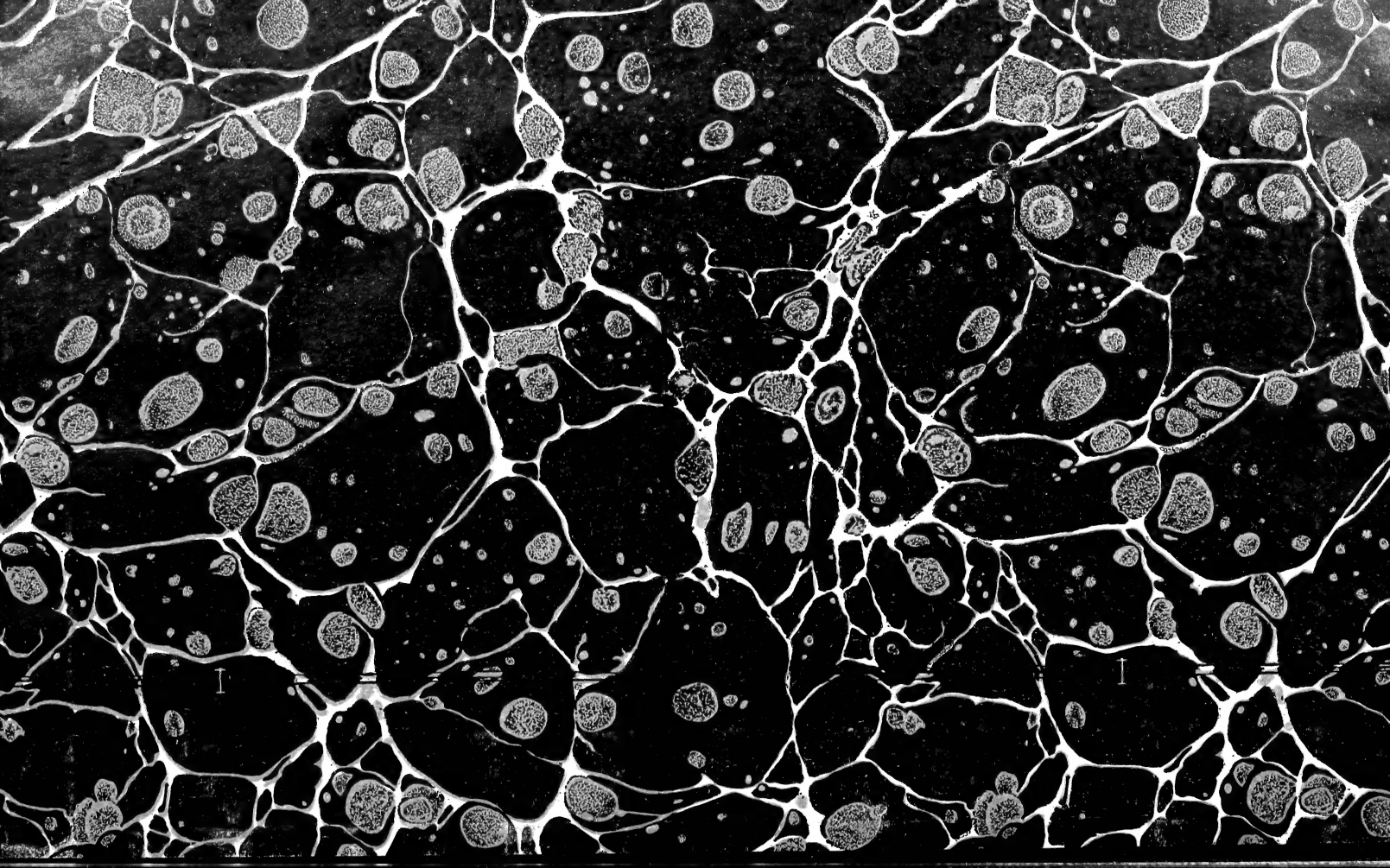

UNITED STATES DEPARTMENT OF AGRICULTURE
BULLETIN No. 876

Contribution from the Bureau of Plant Industry
WM. A. TAYLOR, Chief

Washington, D. C. PROFESSIONAL PAPER September 1, 1920

HAIRY-VETCH SEED PRODUCTION IN THE UNITED STATES

By

L. W. KEPHART, Scientific Assistant, and ROLAND McKEE, Assistant Agrostologist, Office of Forage-Crop Investigations

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CONTENTS.

USES OF HAIRY VETCH.

Hairy vetch, also termed "Russian vetch," "sand vetch," and "winter vetch," is a hardy winter-annual legume, with wide adaptations to an unusual variety of conditions and uses. It thrives in nearly all soils and climates and is probably more widely distributed than any other leguminous forage crop except sweet clover. It is used for nearly every purpose for which forage crops are employed, being grown for hay, pasturage, soiling, green manure, a cover crop, silage, and seed. The plant is especially noteworthy for its ability to grow on poor soil, for its resistance to cold, drought, and alkali, and for its comparative immunity from insects and diseases. These qualities make hairy vetch a valuable crop under any circumstances, but they have led especially to the use of the plant for building up

poor soils and as a substitute for red clover, alfalfa, and the grasses in regions where these crops do not flourish. Hairy vetch has thus come to be considered as essentially a poor-land crop. It is equally valuable on richer soils, however, and can be used to advantage in any system of farming where a winter-growing forage crop is desired.

OBJECTIONS TO HAIRY VETCH.

Although there would appear to be innumerable opportunities for a crop of this character, hairy vetch has not met with the general popularity that its good qualities would seem to warrant. The consumption of hairy-vetch seed in the United States increased about twenty-fold in the 5-year period from 1908 to 1913, and the crop is now grown in some part of nearly every State. Nevertheless, hairy vetch is not one of the major forage crops, and the total acreage is far below that of several other crops of seemingly lesser value.

A common objection to hairy vetch is that the plant is a weak-stemmed vine which is unable to stand upright without support. Unless accompanied by a companion crop to which it can cling, it is apt to lodge badly and to make a heavy tangled mass which is difficult to plow under or to harvest. This objection can be overlooked if no other forage crops are available; otherwise it is a real disadvantage.

Difficulty is sometimes experienced in obtaining a stand of hairy vetch, and again in exterminating it after it is well established. Many other forage crops are equally troublesome in these respects, however, and both difficulties can be overcome by proper cultural methods.

In some localities the reputation of hairy vetch has suffered from overadvertising and from too much emphasis on the first word of the name "sand vetch." Although it is true that hairy vetch often makes very satisfactory growth on sandy soils, it has very definite limitations in this respect, and the exaggerated claims of enthusiastic advocates should not be taken too seriously. The name "sand vetch" is misleading, and its use should be discouraged.

By far the most serious objection to hairy vetch and the chief obstacle to its wider utilization is the high cost of seeding. Not only does the seed cost more per pound than that of most other forage crops, but more pounds are required to plant an acre. Prior to 1914 the average cost of seeding an acre of hairy vetch was $2.40 to $3.60, based on a retail price of 8 to 12 cents a pound for seed and a seeding rate of 30 pounds to the acre. Recently the price of hairy-vetch seed has advanced to 30 or 40 cents a pound, and while this is not greatly out of proportion to the advance on other seeds it is a further handicap to more general usage. In addition, hairy vetch must be replanted every year, which is not the case with red clover or alfalfa.

The high cost of seeding hairy vetch is particularly unfortunate, because this plant is one of the very best legumes for building up unproductive soils. The owners of these soils would be especially benefited by the use of a crop of this character, yet they are the ones who are least able to plant such a high-priced green manure.

POSSIBILITY OF CHEAPER SEED.

The cost of seeding hairy vetch can be reduced either by a lowering of the price of commercial seed or by increasing the use of home-grown seed. There is little reason to believe, however, that the seed of hairy vetch will ever be really cheap. For this there are several explanations:

(1) The seed crop must be grown exclusively for that purpose. Unlike the clovers and grasses, there is no by-product in the form of hay or pasturage, and the straw is of relatively little value.

(2) The seed crop is difficult and somewhat disagreeable to handle and is therefore expensive.

(3) A given area saved for seed will replant only a comparatively small acreage. This fact is illustrated in Table I.

TABLE I.—*Comparison of areas necessary for reseeding different forage crops.*[1]

Crop.	Yield of seed per acre (estimated).	Quantity planted per acre.	Area which 1 acre of seed will plant.	Period of profitable utilization.	Acre-years produced from 1 acre of seed.	Percentage of the total acreage that must be saved for reseeding.
			Acres.	*Years.*		
Hairy vetch	210 pounds	30 pounds	7	1	7	14.2
Red clover	100 pounds	12 pounds	8⅓	1	8⅓	12
Common vetch	700 pounds	70 pounds	10	1	10	10
Rye	896 pounds	do	13	1	13	7.5
Sorghum (broadcast)	850 pounds	60 pounds	14	1	14	7
Crimson clover	300 pounds	15 pounds	20	1	20	5
Sudan grass	400 pounds	20 pounds	20	1	20	5
Sweet clover	300 pounds	14 pounds	21½	1	21½	4.6
Cowpeas	720 pounds	30 pounds	24	1	24	4
Alsike clover	150 pounds	5 pounds	30	1	30	3.3
Soy beans	1,200 pounds	30 pounds	40	1	40	2.5
Alfalfa	200 pounds	20 pounds	10	5	50	2
Bur clover (unhulled)	50 bushels	5 bushels	10	5	50	2
Velvet beans	600 pounds	9½ pounds	64	1	64	1.5
Timothy	250 pounds	12 pounds	21	3	63	1.5
Sorghum (rows)	850 pounds	5 pounds	170	1	170	.58

[1] Some of the figures given necessarily have been arbitrarily taken, as varying cropping systems lend themselves to different periods of utilization and because of the lack in some cases of definite statistical data on crop yields.

Although the cost of seeding hairy vetch will probably always be high compared with that of other crops, there are various economies which, if practiced, would tend to lower the cost to the consumer. Chief among these are an increase in the average yield of seed per acre and improvements in the methods of growing, harvesting, and marketing. Nearly every grower of seed can find, by a study of the methods of other growers, some point where he can lower his own cost of production and thus be able to sell more cheaply. Similarly, distributors can find many places where overhead expenses can be cut down without reducing their margin of profit.

SOURCES OF SEED.

In former years the principal foreign sources of supply of hairy-vetch seed were the Baltic Provinces of Russia. Here hairy vetch has long grown wild and has become a more or less persistent mixture with growing grain, from which it is separated after thrashing.

Hairy-vetch seed is also produced in the German provinces of East Prussia, West Prussia, Pomerania, and the region now forming northern Poland. In these districts it is grown in combination with rye, especially for seed. Varying quantities of German seed have been brought to America in years past, but the bulk of the crop of that country goes to other parts of Europe, where hairy vetch is planted for forage.

Since 1915 considerable quantities of hairy-vetch seed have been brought into this country from Canada, principally from the counties of Norfolk and Elgin in southern Ontario. However, seed is also sent from this country to Canada, but the excess of the imports from that country over the exports to it is approximately 20,000 pounds annually.

The total importations of hairy-vetch seed for the fiscal years 1905 to 1919 are shown in Table II.

TABLE II.—*Reported annual imports of hairy-vetch seed for the 15-year period ended June 30, 1919.*

Year.	Total importations of hairy-vetch seed (pounds).			Year.	Total importations of hairy-vetch seed (pounds).		
	Reports of the Department of Commerce.[1]	Reports of the Customs Service to the Seed Laboratory, Department of Agriculture.	Permitted entry under the seed importation act.		Reports of the Department of Commerce.[1]	Reports of the Customs Service to the Seed Laboratory, Department of Agriculture.	Permitted entry under the seed importation act.
1905	73,245			1913	4,547,824	1,947,798	
1906	68,354			1914	3,405,750	2,476,743	
1907	208,100			1915	451,713	465,726	
1908	242,332			1916			67,683
1909	294,896			1917			295,600
1910	542,948			1918			231,200
1911	954,025			1919			256,500
1912	890,651						

[1] Probably including vetches other than hairy vetch.

Hairy-vetch seed has been produced in America since the plant was first cultivated here, but the real business of commercial seed production dates from 1915. Prior to that time a few growers in Michigan and in scattered localities in other States had been saving seed for sale, but most of the seed grown in America was simply for local consumption. Indeed, American-grown seed was not looked upon with favor by the commercial seed dealers, partly because it was more troublesome to obtain than imported seed and partly because of the peculiar preferences of the seed trade for old-established sources.

When trade with Europe ceased in 1914 hairy-vetch seed was one of the many articles which immediately became scarce, and a demand

arose for home-grown seed. As Michigan was the only State that was producing hairy-vetch seed in any considerable quantity before the war, it naturally became the leader in the suddenly awakened industry, and it now produces one-half or more of the hairy-vetch seed used in this country. In the years from 1915 to 1919 about 1,000,000 pounds were produced annually.

Of the total hairy-vetch seed produced in Michigan, about 5 per cent is used for replanting for seed,[1] 20 per cent is sold locally for general use, and 75 per cent enters the seed trade. Of this 75 per cent, probably two-thirds, or approximately 250 tons, is shipped beyond the borders of the State and constitutes 60 to 70 per cent of the supply available in other States.

Small lots of hairy-vetch seed are available locally in Indiana, Ohio, New York, Pennsylvania, Connecticut, Virginia, North Carolina, South Carolina, Georgia, and Alabama. None of these States is self-supporting in its vetch-seed requirements, however, nor are any of them important factors as producing areas.

On the accompanying map (fig. 1) are shown the localities in which hairy-vetch seed is known to have been produced in commercial quantities since 1914.

The practice of raising hairy-vetch seed at home for strictly local consumption is increasing and will probably continue to increase, especially in the South, where the price of commercial seed is highest. Home-grown seed usually is used just as it comes from the thrasher and sells for a much lower price than fancy recleaned commercial seed. There is no way of estimating the production of home-grown seed, but the total is quite large.

SEED-PRODUCING AREAS IN MICHIGAN.

Hairy-vetch seed is produced in Michigan in three rather distinct areas—the orchard districts along Lake Michigan, the sandy areas of northern Michigan, and the wheat-growing sections in the southern part of the State. Formerly the bulk of the crop came from the orchard districts, where hairy vetch has long been used as a winter cover crop and for green manure. Many of the orchardists grow seed for their own use and sell their surplus to the trade. Thus, seed from this source is simply a by-product. However, the quality of the seed is good and the quantity, in the aggregate, considerable.

During the past five years a special hairy-vetch seed industry has developed in the sandy regions of northern Michigan, where the plant is grown in combination with rye. On most of the sandy soils the number of cash crops that can be grown is limited, and the addition of hairy-vetch seed to the list has been very welcome. In several counties this seed has become one of the major crops and as

[1] When hairy vetch is grown for seed, only about half as much seed is planted per acre as when the crop is grown for forage. This accounts for the apparent discrepancy between the figures here and in Table I.

much a standard product as rye, beans, potatoes, or buckwheat. The yields obtained are not large, as a rule, but the seed is of high quality, good color, and practically free from weed seeds.

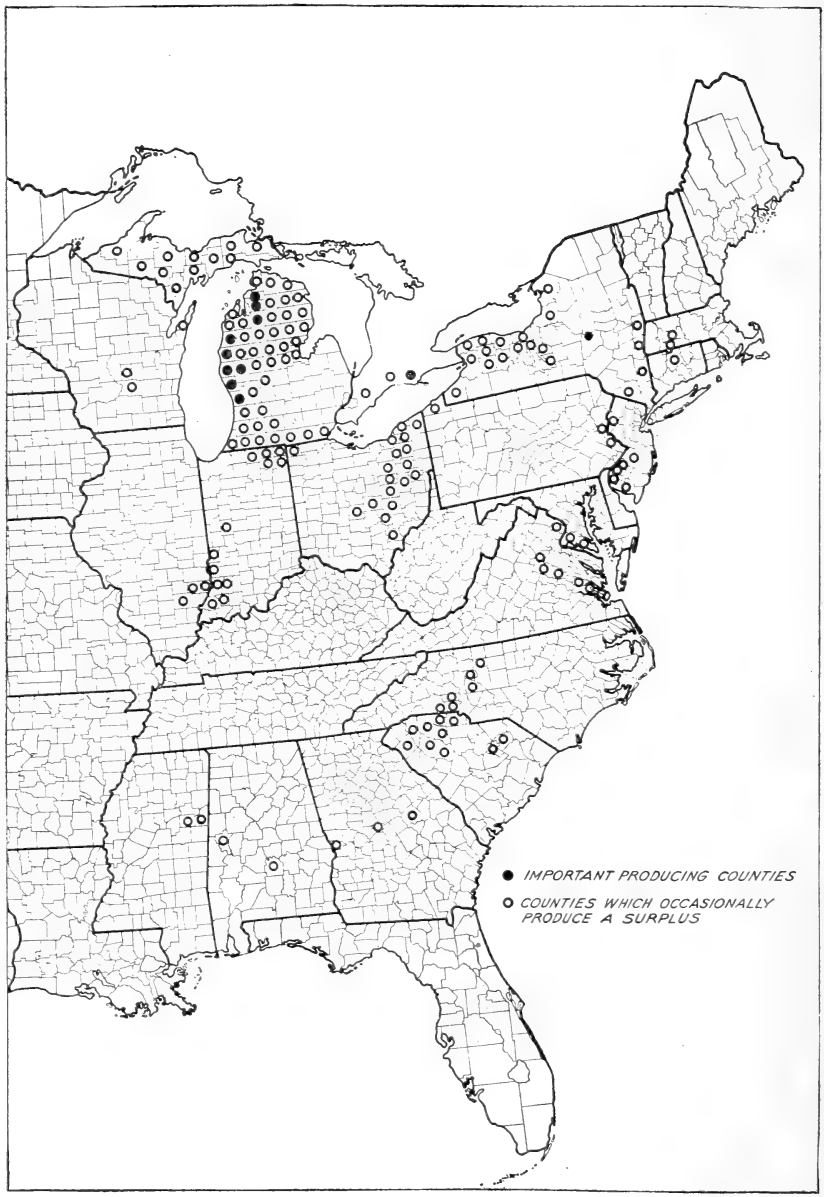

FIG. 1.—Outline map of the eastern portion of the United States, showing the approximate location of the counties in which hairy-vetch seed is known to have been produced.

A third source of vetch seed is in screenings from wheat. Hairy vetch was planted years ago in many of the winter-wheat sections in southern Michigan and still persists in the fields as a weed. Vetch is

considered very objectionable in wheat, and the two are never grown together intentionally, except occasionally for hay. The wheat plant is not tall enough to support the vetch properly and ripens several days later than vetch. The seeds are very difficult to separate, but unless separated cause severe dockage. Wheat containing as high as 3 pounds of hairy-vetch seed per bushel usually yields enough vetch seed on separating to pay the cost of separation. A lesser quantity reduces the value of the wheat 10 to 20 cents a bushel. Hairy-vetch seed from this source is more likely to contain seeds of cockle and other weeds than that from other sources, but is less liable to contain immature vetch seed.

The centers of production of hairy-vetch seed shift from year to year, but the Michigan counties of greatest production in the approximate order of importance are Oceana, Muskegon, Ottawa, Newaygo, Allegan, Mason, Manistee, Kent, Antrim, Ogemaw, Barry, Charlevoix, Osceola, Wexford, Kalkaska, Grand Traverse, and Benzie. The counties along Lake Michigan are the largest producers of seed, but they are also the largest users and do not necessarily export as much as some of the counties farther inland. Vetch seed has been raised in nearly every county in Michigan at one time or another, but in the eastern half of the State the industry is not important.

GROWING THE SEED CROP IN MICHIGAN.

Hairy vetch that is to be saved for seed is handled somewhat differently from that grown for forage or green manure. The general cultural requirements of the plant are much the same, but the details of planting, harvesting, and marketing are different. A thorough understanding of tnese details is necessary for the best success with a seed crop, and failure to observe them may result in very unsatisfactory returns.

SOIL AND CLIMATIC REQUIREMENTS.

The best crops of hairy-vetch seed are produced on medium rich soils in regions of moderate rainfall and fairly cool temperatures. Conditions favorable to the best development of potatoes may be regarded as standard for hairy-vetch seed production. Excessive plant food and unusual warmth and moisture are to be especially avoided, as they promote luxuriant vegetative growth at the expense of the seed-bearing pods. A fairly dry, cool sandy loam, not too well supplied with nitrogen, gives the most profitable returns. Such conditions produce stocky, robust vines, heavily set with pods, giving the highest possible yields with the least trouble and expense. In choosing a location for seed production, therefore, it is better not to use the richest land on the farm, but rather a field that has not recently been manured or has not been growing heavy crops of clover, alfalfa, or other legumes.

On the other hand, seed production should not be attempted where the soil is too poor; under such conditions the plants lack vigor and produce a small crop of low-quality seed. This mistake has sometimes been made in north-central Michigan on the light blow sands and jack-pine plains, where the soil is almost pure sand and contains practically no organic matter. For a few years after the land is cleared these soils produce fairly good crops, but unless steps are taken to renew the humus, the original supply is soon exhausted and the soil becomes barren.

Some of the best crops of hairy-vetch seed in Michigan are grown on poor sandy land which has been rejuvenated. The process of rejuvenation is slow, however, and vetch must be grown for several years before a profitable stand can be expected. The first year after planting, only a few scattered plants appear, regardless of how heavily the seed is sown. The stand improves somewhat during the second and third years, but it is not until the fourth or fifth year that a full stand can be secured. After that, if the soil is at all suited to the crop, the yield of seed will be quite regular, although never equaling that obtained in richer areas.

The conclusion is quite clear that no attempt to grow hairy vetch either for forage or seed should be made by the settler on poor sandy lands unless he is prepared, financially and otherwise, to wait several years for a crop.

Hairy vetch is less sensitive to acid soil than red clover, but soils which are excessively "sour" must have applications of lime. A total of 1,500 pounds of hydrated lime or 2,000 pounds of finely ground limestone per acre applied and worked thoroughly into the soil just before the rye and vetch are sown, usually will be found very beneficial.

No experimental data are available to show whether commercial fertilizers can be profitably applied to the hairy-vetch seed crop. Nitrogenous fertilizers probably are not desirable, but it is believed that phosphoric acid and potash applied to the rye have a beneficial effect on the hairy vetch as well.

INOCULATION.

A frequent cause of failure in growing hairy vetch is lack of inoculation. This is indicated by a yellow, sickly condition of the plants and the absence of nodules on the roots. The proper nodule-forming organisms are usually present in any field where garden peas, field peas, sweet peas, or any of the vetches have grown successfully, and they can be introduced into another field by transferring soil from these fields. Laboratory cultures of the inoculating organism also can be used.[1]

[2] Pure cultures of inoculating organisms can be obtained from dealers, or in small quantities they may be procured without cost upon application to the United States Department of Agriculture or to the State agricultural experiment stations.

SUPPORT CROPS.

Whether for hay or seed, hairy vetch rarely is grown alone, but nearly always in combination with some grain crop to hold it off the ground. For seed production, winter rye is used almost exclusively. Spring wheat, oats, or barley sometimes is drilled into thin stands of hairy vetch in the spring in order to produce hay. Occasionally they are allowed to produce seed, but as they ripen several weeks later than hairy vetch the vetch is apt to shatter badly before the grain is ready to harvest.

Rye and hairy vetch form a very useful combination, having somewhat the same relation to each other as timothy and red clover. Both are outcasts of the wheat field and neither is very profitable by itself. When grown together, however, the mixture has many advantages. The growing period of the two plants is practically identical except that hairy vetch must be planted a few weeks earlier than is absolutely necessary for rye. The rye plant is tall and strong and holds up the hairy vetch nicely, and it is believed that the vetch by adding nitrogen to the soil increases the growth of the rye. The plants are harvested and thrashed together, the combined yield being greater than either crop alone. The presence of hairy vetch adds to the feeding value of the rye straw, which would otherwise be difficult to utilize. Thus, by the partnership neither plant is injured, but each is helped by the presence of the other.

In recent years, an important development in growing rye and vetch together has been the introduction of improved varieties of rye, particularly the Rosen rye. This variety commonly outyields ordinary rye and is consequently more profitable. A further advantage is that the straw of Rosen rye is somewhat shorter and stiffer than that of ordinary rye, while the seeds are a few days later in ripening, thereby allowing more time for the vetch to mature. The only objection to Rosen rye is that the kernels are plumper and more nearly round than those of ordinary rye and hence are slightly more difficult to separate from the vetch.

USE IN THE ROTATION.

When hairy vetch is grown especially for seed, it must become part of a regular crop rotation. It can not be grown merely as a catch crop to be fitted into the cropping system at odd seasons. When hairy vetch is grown for hay or green manure it is usually out of the way by the middle or last of May, in time for planting corn or any late-planted summer crop. The seed crop, however, is not harvested until July or August, at which time there is no chance for another crop that season.

Hairy vetch for seed is sown with rye, and the mixture is handled in practically the same manner as rye grown by itself. The crop

follows corn as a rule, although it may succeed early potatoes or a grain crop. Hairy vetch must be planted by September 15, and therefore it can not follow late potatoes, beans, or sugar beets, which occupy the ground until the latter part of that month. Occasionally the vetch is seeded in buckwheat and the rye broadcasted later. Rye and vetch seldom follow well a timothy meadow, as the old sod is hard to subdue.

Hairy vetch and rye can be succeeded by any crop that follows wheat or rye. A common rotation on the heavier soils is (1) potatoes or beans, (2) corn, (3) rye and hairy vetch, (4 and 5) timothy and mixed clover. On sandy soils and in the northern counties timothy and red clover may well be replaced by orchard grass and sweet clover, but in either case the rotation provides for two legumes in three years with one plowing. More or less volunteer hairy vetch appears in the clover at the first cutting, but it disappears entirely by the time the second crop is ready.

A serious objection to saving hairy vetch for seed is the sacrifice of the green manure, which in many cases is the principal object in growing the crop. A rotation that provides for both seed and green manure is the simple one of (1) corn, (2) rye and hairy vetch. By allowing the hairy vetch to become quite ripe before harvesting, sufficient seed shatters to produce a heavy volunteer stand, which is plowed under in time for corn planting in the spring. The straw from the seed crop is fed to live stock, and the manure is plowed under or spread on the ground in the fall. In either case, two crops of vetch are turned under every two years and in addition a cash crop of corn and one of vetch seed secured.

Hairy vetch and rye are sometimes grown year after year on the same ground, especially in areas where conditions are not favorable for corn. This system has the advantage of providing a money crop each year with little labor or expense, but the yields fall off rather rapidly even when the straw is returned. Continuous vetch growing should be accompanied by a yearly application of phosphatic fertilizer, or on cheap land the crop should be saved for seed one year, followed by a volunteer green-manure crop the next.

In orchards hairy vetch and rye are usually grown continuously, as the primary purpose of the crop is for winter cover and green manure. In a few localities the constant plowing under of a leguminous green-manure crop is no longer thought desirable, as the soil becomes too rich in nitrogen for the best growth of the trees. In such cases the seed crop offers a means of disposing of the plants without plowing them under, while still having the use of a winter cover crop. In most orchards, however, hairy vetch is more valuable for green manure than for seed, and it is doubtful whether a seed crop should be removed more often than once in two or three years.

TIME OF SEEDING.

Next to improper soil conditions, delayed seeding is the most frequent cause of vetch failures. Hairy vetch is an extremely hardy plant and withstands cold weather even better than rye, but the plants must be well established and firmly rooted before entering the winter. Rye may be seeded as late as November 1, but the vetch must have more fall growth. There is little danger of having too much growth, provided the plants do not blossom before frost; therefore, the general advice in seeding hairy vetch is "seed early."

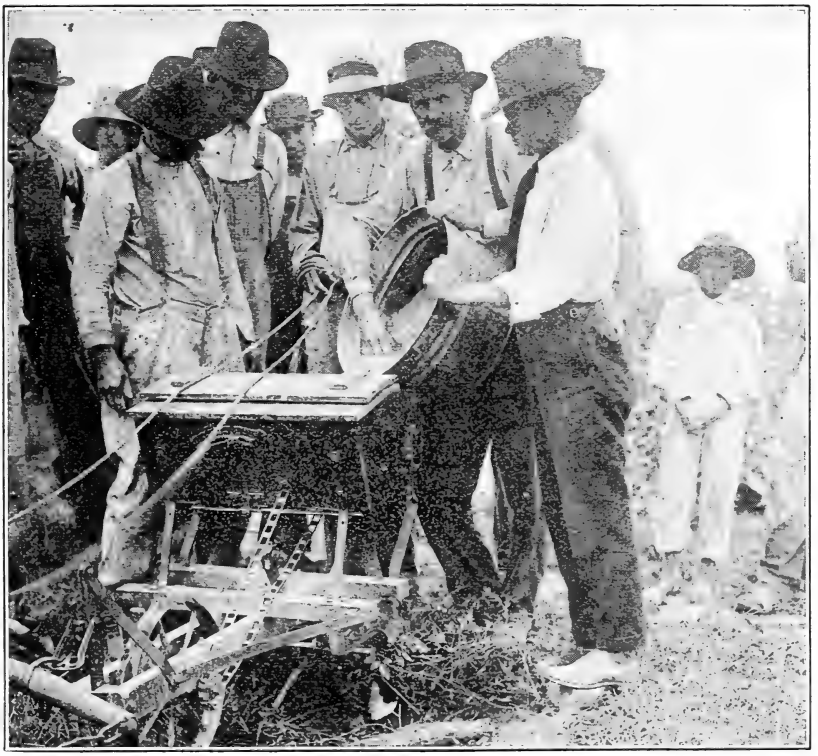

FIG. 2.—The 3-hoe 1-row grain drill. The machine is being filled with hairy-vetch seed, oats, and dry soil, the latter carrying the inoculating bacteria.

Most successful vetch growers advise seeding rye and hairy vetch in corn at the last cultivation, which usually occurs about August 10 to 20. All are agreed that seeding should not be delayed later than September 15 if a full stand is to be secured.

METHODS OF SEEDING.

In seeding hairy vetch and rye in corn, the mixed seed can be sown either broadcast or with a 3-hoe 1-row grain drill. (Fig. 2.) Broadcasting can be done on foot or from horseback, either with a rotary seeder or by hand. Broadcasting from horseback requires a steady horse and an expert sower, as most horses object to the

waving arms and flying seed. In using the rotary seeder the hairy-vetch seed is thrown a little farther than the rye, to counteract which it is well to sow half of the seed one way of the field and half the other.

For sowing on grain stubble, corn stubble, or other unoccupied land, a regular grain drill is convenient. If the field has been kept free from weeds the only preparation needed is to disk the ground thoroughly and pack it with a corrugated roller. Some types of drills handle the mixed seed very satisfactorily, but in others the hairy vetch works to the bottom of the box, so, when these are used, the vetch must be sown separately with a broadcast seeder.

RATE OF SEEDING.

For the most profitable yield of seed it is important to sow the rye and hairy vetch at just the right rate and in the proper proportion. Too little or too much seed may mean the difference between profit and loss. The mistake most frequently made is to sow too heavily, under the impression that the heavier the seeding the greater will be the yield and profit.

Heavy seeding is all right for hay or green-manure crops, but for seed production a relatively light seeding is desirable. In a thick stand, owing to the density of the foliage, the sunlight does not penetrate to the bottom of the mass of vines, and the blossoms on the upper branches are frequently the only ones that develop into pods. Even if pods are formed throughout the plant, the lower ones usually ripen before the ones above and shatter their seeds before the rest of the crop is ready to harvest. Unevenly ripened seeds are not uniform in color or size, some being large and black, while others are small and greenish. Such seed does not bring the top price on the market and must be severely recleaned, which reduces the net yield by 30 or 40 per cent. In a stand that is full but open to the sunlight, the plants are likely to be uniformly covered with pods and the pods will ripen very nearly at the same time.

Almost invariably a heavy stand of hairy vetch is badly tangled and lodged before the seed crop is ready to harvest. The extra cost of harvesting such a crop usually more than offsets any increase in yield that may be obtained. A heavy stand, furthermore, is more subject to injury from insects and diseases.

Successful seed growers usually advise planting only as much hairy vetch as the rye will hold up without lodging. (Fig. 3.) The exact rate of seeding varies with the method used and the type of soil, and no rule can be given that will cover all circumstances. More seed is required for broadcasting than for drilling, and more is needed for late fall planting than for planting in August. Poor soil requires more seed than good soil, not only because there is likely

to be a poorer stand, but also because the plants which are produced are not so large or thrifty. Soil which has never produced hairy vetch usually requires twice the quantity of seed necessary on soil where the crop has been grown repeatedly.

The following rates of seeding per acre may be considered the average in Michigan: On sandy soils and coarse sandy loams, 18 pounds of hairy vetch in from 3 pecks to 1 bushel of rye; on fine, sandy loam, 15 pounds of hairy vetch in 1 bushel of rye; on gravelly clay loam, 10 to 12 pounds of hairy vetch in 1 bushel of rye. These figures vary widely and are at best only approximations, but they may assist the grower in determining the proper quantity to sow.

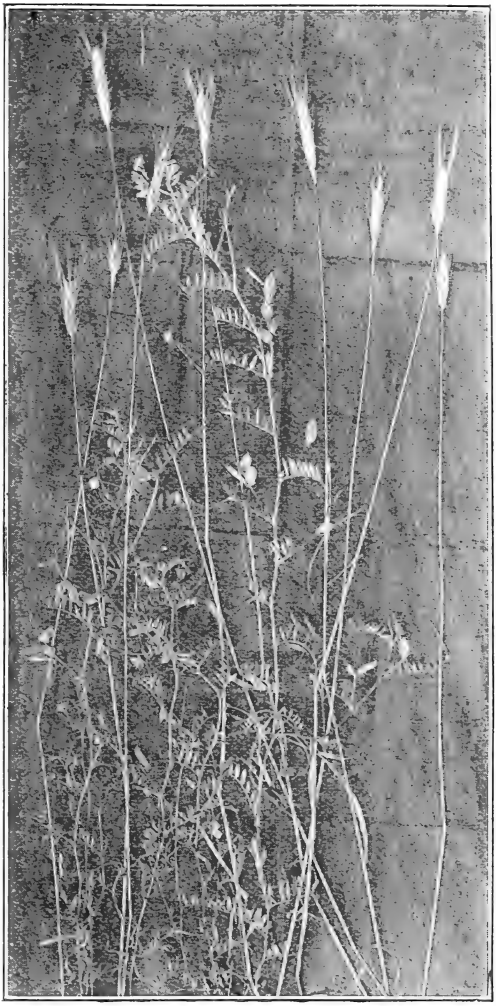

FIG. 3.—Rye and hairy vetch in the proper proportions for a seed crop. More hairy vetch would drag down the rye.

On fields where rye and hairy vetch follow rye and hairy vetch, a considerable saving in seed is possible because of the volunteer crop which usually comes up from the seed shattered in the previous harvest. This growth often amounts to one-third to three-fourths of a full stand. Reseeding is frequently avoided by allowing the crop to become dead ripe before harvesting, this practice being especially popular in districts where hairy vetch is just becoming established. This method saves labor in preparing the seed bed and planting, but the practice is very wasteful of seed, as there are frequently 3 or 4 bushels of shattered seed to the acre, whereas a peck is sufficient for planting. In the long run it is usually better economy to harvest all the seed possible and resow whatever quantity is necessary.

USE OF READY-MIXED SEED.

The sowing of ready-mixed hairy-vetch and rye seed is not considered satisfactory when the crop is to be saved for seed. The chief objection to this is that one does not know how much vetch is being sown. Even the most experienced growers are seldom able to judge within 3 or 4 pounds of the percentage of hairy vetch in a lot of mixed seed, the blackness of the mixture being a very deceiving index. Since the exact proportion of rye to hairy vetch is a very important factor in producing a profitable seed crop, each grower should procure unmixed seed and mix it according to his own formula.

In ready-mixed seed the proportion of hairy-vetch seed is not high enough as compared to the rye, the natural mixture usually containing only 5 to 8 pounds of the vetch seed per bushel instead of 9 to 18 pounds, which is required for a seeding mixture. Consequently, the mixture must be enriched either by adding more vetch or by running the mixed seed through a fanning mill or cleaner to remove some of the rye. Even with the expert operation of the fanning mill and frequent testing of the product, an exact proportion of the two seeds is very difficult to obtain; therefore, most persons find it less trouble to use unmixed seed than to try to grade up their own mixed seed with a fanning mill.

Another drawback to ready-mixed seed is that the quality is usually very uneven, consisting of good, bad, and indifferent seeds, together with more or less broken seed and trash. Such seed produces an uneven crop and may be the carrier of weed seeds, especially those of cockle, chess, and wild mustard.

HARVESTING IN MICHIGAN.

TIME OF HARVESTING.

As a seed plant hairy vetch is inferior to clover, wheat, timothy, and most other farm crops in that the seeds do not all ripen at the same time. The pods on the lower branches develop first and usually shatter their seeds before those in the upper pods have begun to turn black. Not more than 85 per cent of the entire crop is present on the vines as ripe seed at any one time, the remainder being either shattered or immature. Consequently, there is no possibility of saving all the seed produced, and the best one can do is to harvest when the highest possible percentage of ripe seeds is on the plants.

The harvest season in Michigan lasts about 10 or 12 days, usually beginning about July 15. The changes during these days are rapid, and the grower must watch the field carefully if he expects to harvest the plants at any particular stage of maturity.

Opinions differ among growers as to the stage of growth at which the seed crop should be harvested. Some prefer to harvest the crop as soon as three-quarters of the pods are ripe and when most of the leaves are withered. This occurs as a rule just when the rye

is ready to cut. The advantage of early harvesting is the avoidance of a heavy loss of seed from shattering; the disadvantage is the greater difficulty of harvesting. When cut early the vines are still green and tough, causing more or less trouble and annoyance in harvesting and thrashing. (Fig. 4.) Then, too, the seeds are not uniformly ripe, and although the green seeds ripen considerably in the stack, they do not become quite so black as normally ripened seed. Furthermore, so many of the seeds are entirely immature and worthless that the yield is often reduced 10 or 15 per cent by the time the crop is graded and ready for market.

To avoid these difficulties many of the larger growers allow the crop to stand in the field until the pods are dead ripe and most of

FIG. 4.—Harvesting semigreen hairy vetch with a mowing machine. Note the tangled mass that clings to the cutter bar. This difficulty can be largely overcome by the use of a swather attachment.

the leaves fallen. This does away with trouble in harvesting and improves the quality of the product. The loss of seed from shattering, however, is often severe, sometimes exceeding 50 per cent. Rye, as a rule, does not shatter badly and can be left in the field for a week or more after the seeds are ripe. The hairy-vetch pods, however, begin to split and curl almost as soon as they become dry, causing the seeds to fall to the ground at the slightest provocation. The advocates of late harvesting claim that the saving in labor more than compensates for the seed wasted and contend that the yield of good seed is as large as when the crop is harvested green and the seed graded. They further point out that the scattered seed produces a volunteer crop the following winter and thus furnishes the only means by which a hairy-vetch seed crop can act as a soil improver.

Probably the advantages of the two methods are very nearly equal, and the decision as to which to use depends on the kind of harvesting machinery available.

In seasons of plentiful rainfall, hairy vetch is sometimes pastured early in the season or harvested for hay and a second crop secured for seed. The second crop is rather uncertain and only rarely produces more than half as much seed as the first crop would have done, although the combined value of hay and seed may exceed that of seed alone. The second crop consists of one or two straggling stalks from each root. These stalks usually lie so close to the ground that special knife guards on the mowing machine are necessary to pick up the prostrate vines. (Fig. 5.)

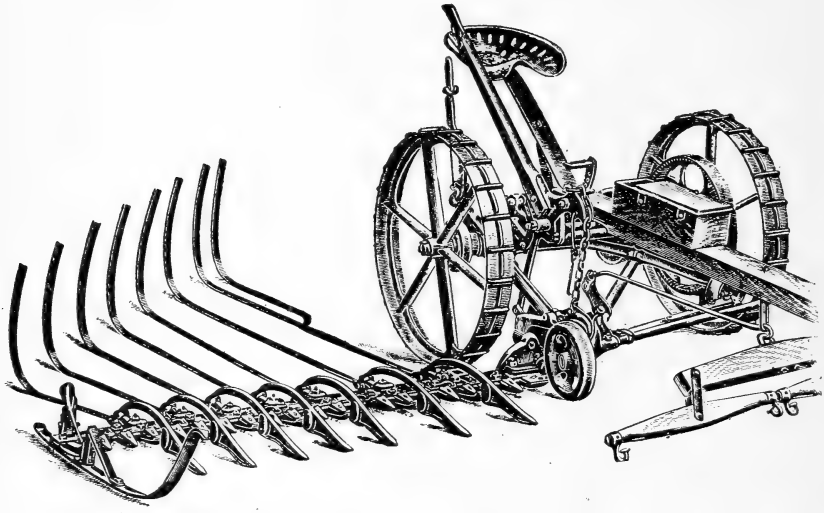

FIG. 5.—A mowing machine equipped with lifter guards and a side-delivery bunching attachment for harvesting lodged vetch.

METHODS OF HARVESTING.

When hairy vetch is harvested in the semigreen stage it can be cut only with a mowing machine or by hand. Neither the binder nor the self-rake reaper can be used in green hairy vetch, as the knives and elevators become hopelessly tangled and choked, while the bundles hang together in strings and can hardly be discharged from the machine. Even with a mowing machine the task of harvesting green hairy vetch is not easy, and the driver must expect to stop frequently to clear away the vines from the cutter bar. In cutting green hairy vetch a mower with a short cutter bar, 4½ or 5 feet long, is easier to operate than a larger machine, and because of the less frequent stops it covers quite as much ground in a day. Some kinds of mowers can be equipped with a short, stout, double-bladed bar, known as a brush-cutting bar, which has been found very satisfactory in a heavy growth. Hairy vetch which is badly lodged can be mowed only in the direction opposite to that from which the

wind blew, as when going "with the wind" the cutter bar slides over the prostrate vines without cutting them.

After mowing, the crop is allowed to lie on the ground for a few hours until the excess moisture has evaporated. The swaths are then raked into loose piles with a hayrake driven at right angles to the mower, to avoid stirring the vines more than necessary. Even at this stage the pods shell easily, and should be handled as little as possible.

As soon as the vines are cured, but before the pods are thoroughly dry, they should be hauled to the barn and stored on a tight floor or on an old canvas hay cover. Not uncommonly 3 or 4 bushels of first-class seed shatters out of a good-sized mow before the thrasher arrives, and this, if saved, is often enough to pay the entire cost of thrashing. In no case should hairy vetch be left in the field longer than is necessary to dry out the stems; neither should it be stacked out of doors unprotected if there is any way to get it under cover. Not only is there a heavy loss of seed from shattering, but the quality of the seed which remains is subject to injury from mildew and weathering. In case of prolonged wet weather the seeds are likely to sprout in the stack.

The practice of the largest growers indicates the most economical method of producing hairy-vetch seed to be to sow the crop rather lightly and, when thoroughly ripe, harvest with a reaper or with a mowing machine equipped with a clover buncher. Mature hairy vetch plants are dry and brittle and break apart readily, so that harvesting such plants is no more difficult than harvesting an ordinary field of grain or clover. The reaper is preferred to other harvesting machines because it handles the seed-laden plants gently and deposits the gavels, or bunches, in convenient rows out of the way of the horses. For those who do not own a reaper, a clover buncher on a mowing machine is an inexpensive and satisfactory substitute. Clover bunchers which deliver the bundles at the side are preferred to those which discharge at the rear, as they do not leave the bundles in the path of the machine on the next round. However, the side-delivery bunchers roll the crop considerably in turning the windrow to one side and some seed is shattered.

Ripe hairy vetch should be harvested at night, or at least very early in the day, while the pods are still damp and tough from the dew. The best hours are from midnight until 7 or 8 in the morning. This may seem a hardship, but will be found well worth while in the extra quantity of seed obtained. If harvesting is delayed until late in the day, the pods dry out to such an extent that the hum of the mowing machine is accompanied by a popping of the pods as a shower of seed falls to the ground behind the harvester.

Unless the weather continues rainy or humid, the gavels should be picked up within an hour or so after cutting and hauled to the barn

or shed. Hay wagons may be used for hauling, but they should be provided with a canvas in the bottom of the rack to catch the seed which falls. For large-scale operations a special wagon box, somewhat like the header bed used in western wheat fields, is constructed from matched lumber and mounted on a low-wheel truck or on skids. The box is made large enough to hold 1½ or 2 tons of grain, but should not be so large as to be cumbersome, a convenient size being 16 feet long, 6 feet wide, and 2½ feet deep. Such an outfit permits the rapid handling of the crop, and saves several bushels of seed in the course of a day. The bundles are thrown into the box with 4-tine header or barley forks, with which the bundles are more quickly and cleanly handled than with ordinary hayforks.

As the self-rake reaper is not a common implement on most farms, a large percentage of the hairy-vetch seed crop is harvested with grain binders. The binder shatters much more seed than the reaper, owing to the crushing and beating action of the elevators and packers. Frequently one-quarter or more of the pods are empty before the bundles reach the ground. Some of the seed which is thus thrashed out accumulates under the aprons of the machine and can be saved, but most of it is wasted. No special apparatus has been devised for saving this seed, but it would seem to be well worth while to have the binders equipped with pans under the elevators and binder deck, similar to those used in harvesting sweet-clover seed.[3] From the appearance of the bundles as they leave the machine, it seems safe to say that the yield of every field harvested with a binder could be 20 to 50 per cent larger if these inexpensive attachments were used.

When cut with a binder the bundles of hairy vetch and rye are usually set up in shocks the same as is done with grain, although this is not necessary if the crop is thoroughly ripe and dry. The shocks are not made long and narrow, as is the case with oats, but large and compact, in order to reduce the outer surface, where the pods would dry rapidly and shatter. The length of time the shocks should remain in the field depends on the ripeness of the crop and the condition of the weather, but seldom should exceed three or four days.

THRASHING.

Hairy-vetch seed is thrashed with any ordinary grain separator and presents no special difficulties if the vines are dry. Mixed rye and hairy vetch is run through the machine in the ordinary manner, usually without any adjustment of the cylinder or of the screens. A little care must be taken that the machine is not run too rapidly, as the hairy-vetch seeds are apt to crack and split, especially in dry weather or when the seeds are dead ripe. A good thrasherman, of

[3] These pans are illustrated and described in Farmers' Bulletin 836, entitled "Sweet Clover: Harvesting and Thrashing the Seed Crop." Copies of this bulletin can be obtained free upon application to the Division of Publications, United States Department of Agriculture, Washington, D. C.

course, does not run his machine so fast as to injure the hairy vetch, but many operators habitually run at an excessive rate of speed, and these must be cautioned to proceed more carefully. At times it may be necessary to change the pulleys, to allow the cylinder to run more slowly than the rest of the machine. Just as much seed is thrashed in a day by running slowly, because less seed goes over in the straw. When the speed of the cylinder is not reduced it is advisable to remove some of the concave teeth.

Thrashermen who are accustomed to hairy vetch and rye do not as a rule make any extra charge for thrashing, but treat the mixed crop like straight rye, provided the output from the machine is the same for a day's run. When too much hairy vetch is present, the daily output is cut down and the thrasherman charges 1 or 2 cents a bushel extra to make up for the difference.

The greatest difficulty in thrashing is likely to come in attempting to thrash a semigreen crop. All thrashermen object to working with the tough, wiry vines, as they wind around the cylinder, become tangled in the shakers, and cause an endless amount of trouble and loss of time. Cases are known where farmers have been charged as high as 18 cents a bushel for thrashing such a crop, and the charge is not wholly unreasonable in view of the difficult nature of the work. In order, therefore, to avoid argument as to price and to insure running the machine at the proper speed, it is usually best when thrashing green hairy vetch to pay for the thrashing by the day instead of by the bushel, as is commonly done. Most thrashermen consent to such an arrangement provided the agreement is reached before the work is started and they are insured the normal daily earnings.

DISPOSAL OF THE CROP IN MICHIGAN.

CLEANING AND SEPARATING.

Since hairy vetch is usually grown as a companion crop with grain, the seed must be cleaned and separated from the grain before it can be marketed as commercial seed. Cleaning is accomplished by means of an ordinary fanning mill or seed cleaner, which removes the trash, weed seeds, and more or less of the grain. Most farmers and all elevators have cleaning machines of some kind, and any machine that cleans grain will clean grain and hairy-vetch seed in mixture.

To remove the grain from the hairy vetch is a more difficult process, as the seeds are so nearly of the same size, shape, and weight that no ordinary machine separates them. Small lots of seed can be separated fairly well in a fanning mill and the excess grain picked out by hand. A better method is to pour the mixed seed on a smooth slanting surface, such as a tin shed roof, to which have been fixed horizontally thin strips of wood. By sweeping the mixture up the slope with a broom, the grain is held back, while the hairy-vetch seeds roll down the slope and off the edge. A similar plan consists

of a series of inclined steps, arranged about 2 inches apart, over which the mixture is allowed to run. About three-fourths of the rye falls through the openings. The simplest method of all is to spread the seed on a barn floor and allow chickens to pick out the grain, which they will do, leaving the hairy vetch. Separation can also be accomplished on clover graders or wild-oats separators, which consist essentially of endless belts of felt or Canton flannel set at such an incline that the rye is carried up and over the top while the hairy vetch rolls to the bottom.

Large lots of seed can not be handled in such a manner, however, but must be separated on a spiral separator. This simple but ingenious device is really the keystone of the hairy-vetch seed industry, as without it there would be no way to separate seed in large quantities. The general type of construction of the spiral separator is shown in figure 6.[4]

The spiral separator is operated entirely by gravity and centrifugal force and contains no moving parts. It consists of three or more concentric spiral chutes mounted on a vertical column, the outer chute being larger than the others and fitted with a vertical rim. The mixture of vetch and grain is fed into the hopper at the top of the machine, whence it is distributed equally to each of the small spirals. Upon opening a slide the mixture commences to whirl down through the spirals at a high rate of speed, a given portion traveling from top to bottom in a few seconds. The rye, oats, or other grains, being flat-sided or oblong and not rolling readily, cling to the center of the spirals and are discharged from a central spout at the base. The hairy-vetch seeds, however, being round and smooth, roll quickly to the outsides of the spirals, where they jump over the edge and fall into the large outside spiral. At the base of the large spiral is a vertical partition which divides the stream of hairy vetch into two parts, with the heavy and more nearly round seeds on the outside and the light, irregular or shrunken and broken seeds on the inside. Thus, there is discharged at the bottom of the machine three grades of seed—the grain, the second-grade hairy vetch, and the first-grade hairy vetch. If cockle or other semiround seeds are present, they come out for the most part in the second-grade seed.

Oats are separated more easily than rye, and rye more easily than wheat. Rosen rye is somewhat more difficult to separate than common rye on account of its plumper and more nearly round kernels.

[4] Spiral separators are put on the market by at least four manufacturers in this country and sell for $35 to $85, depending upon their construction and finish. The cheaper machines made of galvanized iron work quite as well as the more expensive ones, which are of heavy sheet iron and castings. The former are popular with farmers, while the latter are preferred by millers. The machines are also useful for removing mustard and other round seeds from grain. There are no restrictions in the way of patents or royalties on the manufacture of spiral separators, but owing to their peculiar design they can hardly be made economically at home.

Very little trouble is experienced with the machine, and it seldom needs repairs. It can be set on a barn floor or in any convenient place and requires no adjustment except to see that the base is level. After three or four years' service the insides of the spirals are sometimes worn so smooth that the rye tends to slip over the edge along with the hairy vetch. This condition can be remedied by roughening the insides of the spirals with emery cloth or sandpaper or by smearing a narrow band of soap or hard grease along the inside of the outer edges. The soap retards the rye just as it is about to jump over, but does not hinder the hairy vetch. The same effect can be secured by slipping thin strips of wood over the edges of the spirals at intervals, so as to deflect the rye toward the center.

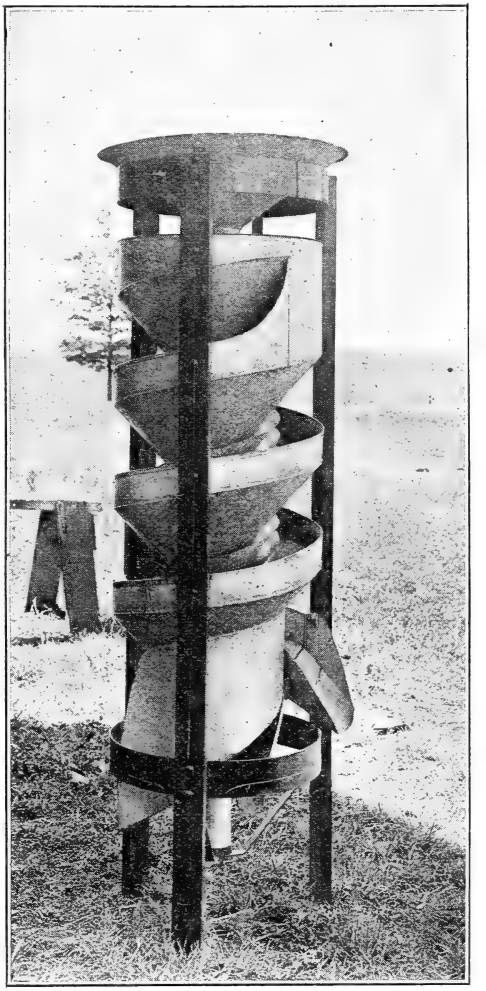

FIG. 6.—A spiral vetch separator, the most efficient separator for removing rye or other small grain from vetch.

The daily capacity of a single spiral separator varies from 25 to 80 bushels of mixed seed, depending upon the facilities available for feeding and discharging. On the farm, where the work must usually be done by hand, 50 bushels is considered a good day's work. One man usually handles a fanning mill and a spiral separator at the same time, thereby reducing somewhat the cost of both operations.

In most of the larger elevators and seed houses the machine is arranged so that the grain is fed from a bin above and discharged into three bins below. In this way the operation becomes practically automatic. All that is necessary to start the machine is to open the slide at the top, when the grain starts down through the spirals and continues to run without interruption as long as there is any seed in the feed hopper. Often the machine is started in the fall and run for days or even weeks at a time without stopping.

the only attention required being occasionally to remove particles of straw or trash that may become lodged in the spirals.

With such an arrangement of bins a single separator can handle 4 to 5 bushels of mixed seed in an hour, or 90 to 120 bushels in a 24-hour day.

Much time is saved and more hairy-vetch seed separated in a day if the mixed seed is first "scalped" by running through a regular seed-cleaning machine to remove some of the grain. The seed cleaner works more rapidly than the separator and will remove 50 per cent or more of the grain, thus leaving the mixture much richer in hairy vetch. The rich mixture not only runs more rapidly through the spirals, but the hairy vetch is graded more evenly. If the seed cleaner is not used, the vetch must often be run through the separator several times to obtain a good separation.

The charge for separating hairy-vetch seed is usually 10 cents per bushel of mixture. This is based on a capacity of 50 bushels of mixed seed a day, although a well-arranged outfit can handle 65 to 75 bushels in 10 hours. On the basis of 5 pounds of hairy vetch per bushel the cost of separating is about 2 cents a pound. Ordinarily, a man who grows 8 acres or more of hairy-vetch seed each year can afford to own his own machine. Many farmers who own machines do custom work for their neighbors, charging a little more if they have to move the machine from place to place than if the grain is brought to them. Nearly all local grain and feed merchants in the hairy-vetch districts are equipped to separate and handle vetch seed, and most of them consider the machine a profitable investment. When a local machine is not available, however, the mixed seed can be shipped to one of the large seed dealers who buy the seed and separate it themselves.

MARKETING.

About three-fourths of the hairy-vetch seed grown in Michigan is sold directly to country elevators or to the large seed jobbers, either through their local agents or by correspondence. A few farmers make enough of a specialty of this vetch to advertise in the local papers and sell directly to the consumers. Others are able to dispose of all their product to their neighbors. On account of the rapidity with which the hairy-vetch seed industry developed in Michigan, some time was required to establish a satisfactory marketing system. Many farmers who grew seed with the expectation of receiving high prices found that there was no way to dispose of the seed after it was harvested, as the local dealers were not prepared to handle it. Thus, there has been a considerable inequality in the prices paid to farmers in different sections, and some growers have been forced out of the business because of uncertainty as to the returns. This difficulty is being gradually overcome as business machinery for handling the crop becomes better organized.

Hairy vetch is marketed both as clear seed and mixed with rye. The price received is the same whether the seed is separated before or after selling, as the seller pays the cost of separating in either case. If enough seed is grown to warrant owning a seed cleaner and a separator the grower, of course, makes the profit on this operation, which adds slightly to the value of his crop.

In selling mixed seed the proportion of hairy vetch to rye should be determined by actual measurement of a sample and not merely by guesswork. Owing to the difficulty of making an accurate guess, the buyer naturally guesses light to be on the safe side, which works, of course, to the disadvantage of the seller. Sampling is easily accomplished by weighing a pound of the mixture and separating the hairy vetch by hand. The hairy vetch is then weighed in order to determine the number of ounces per pound of mixture, which figure can be applied to any number of pounds.

Mixed seed should not be sold by the bushel, but by the pound on the basis of the sample taken. Hairy-vetch seed weighs about 60 pounds to the bushel and rye only 56, so that the weight of a bushel of mixture depends on the proportion of the two ingredients. The only way to determine the number of pounds for a bushel of mixture is to weigh a measured bushel, and as an accurate measure is not always available a difference of opinion is liable to arise. On small transactions this matter is not of great importance, but in a deal involving a hundred bushels, a difference of 2 pounds to the bushel means a difference of $8 or $10.

A common practice among the larger dealers is to pay the market price for the hairy vetch and 10 cents less than the market price for the rye, or to pay the regular rate for the rye and 2 cents a pound less for the hairy vetch. The same end is attained by paying the market rate for both the rye and hairy vetch and charging a fixed sum, usually 10 cents a bushel, for cleaning and separating.

A serious obstacle in the marketing of hairy-vetch seed is the length of time that the seed must be carried over between harvesting and sowing. Hairy vetch is harvested late in July and planted not later than September 15, leaving an interval of only four to six weeks for thrashing, cleaning, selling, and shipping. A few farmers are able to get their seed on the market in time for sowing the same year, but the arrangements must all be made before the seed is harvested and the operations of thrashing and hauling hurried with all speed. Most farmers are unable to do this; consequently the bulk of the seed must be carried by some one for a year before it can be sold. This naturally adds to the cost of doing business and increases the price of the seed.

No definite grades or classes of hairy-vetch seed are recognized in the market, nor is there any great need for classification, as the crop is usually of even quality and can be bought quite safely simply

as "hairy vetch." In some sections, weed seeds are a frequent impurity and the hairy-vetch seed is either docked or refused entirely. Sometimes seed is offered that is not fully ripe or that contains broken or shrunken grains. Although there is no evidence to show that greenish or greenish gray seed is not just as good as black seed the trade prefers hairy vetch that is dull black and of uniform size.

DISPOSAL OF THE STRAW.

Hairy-vetch straw is often used as winter roughage for cattle, horses, and sheep, for which purpose it is considered equal to clover straw or somewhat better than bean straw. Sheep especially are fond of the hairy vetch, seeming to relish it better than coarse hay or sweet-clover straw. When mixed rye and vetch straw is fed the animals eat more or less of the rye along with the hairy vetch and maintain their weight or even make appreciable gains when wintered principally on this feed. There seems to be little or no difference in feeding value or palatability between mature hairy-vetch straw and that which is slightly green.

Hairy-vetch straw is sometimes plowed under for soil improvement, especially on farms in need of organic manure. This practice is not the best, as dry hairy-vetch straw decays slowly and tends to dry out the soil, besides interfering with cultivation. However, it contains practically the same amounts of nitrogen, phosphoric acid, and potash as the green plant, and where no better means is available for its disposal, it should be plowed under. The very best way to dispose of the straw is to feed it to live stock and plow under the manure.

SEED YIELDS IN MICHIGAN.

Under favorable conditions hairy vetch yields as high as 10 to 12 bushels of seed per acre. A high yield, however, is not necessarily the most profitable, for it usually involves the handling of such an excessive quantity of tangled vines as greatly to increase the cost of production per bushel. Most growers do not seek high yields, but, in fact, carefully avoid them. Occasionally a large yield of seed is obtained from plants which are small in size but heavily set with pods. Such a crop is, of course, highly profitable, but the conditions which produce these plants are not well understood and they are apt to be the result of chance rather than skill.

A moderate yield of hairy-vetch seed is usually considered more profitable than a high yield and is the standard generally sought. Particularly is this true when hairy vetch is grown with rye. Rye containing a small quantity of hairy vetch can be grown with no more trouble than rye alone, and the vetch seed obtained is regarded as clear gain. This is probably the cheapest method by which hairy-vetch seed can be grown commercially, and it is also the most satisfactory method for the producer.

From 5 to 6 bushels of hairy vetch in 25 to 30 bushels of mixture per acre is considered a very satisfactory yield, comparable to 25 bushels of wheat or 150 bushels of potatoes. A common way of expressing this is to say that a good crop of rye should contain 20 per cent (12 pounds) of hairy vetch per bushel. Nearly all farmers secure such yields in occasional years, but only the most expert growers average that quantity. Probably the average yield approximates 15 to 20 bushels per acre of mixed seed, containing 5 to 8 pounds of hairy vetch to the bushel. This is equivalent to 13 bushels of rye and 2 bushels of hairy vetch for the lower yields, or 17 bushels of rye and 3 bushels of hairy vetch for the higher yields. With reasonable success one should be able to exceed the latter figures at least once in three years.

The profits from growing hairy vetch and rye are increased considerably by the use of improved varieties of rye, such as Rosen or Mammoth White, which commonly yield at the rate of 25 to 30 bushels per acre. At the present time the seed of these varieties, if pure, sells for about twice the price of ordinary rye, on account of being in great demand for seeding purposes. Some effort is required to produce pure-bred rye seed, since rye, unlike wheat, crosses very readily, and the improved varieties therefore must not be grown within half a mile of other rye. The extra care is well worth while, however, in view of the greater returns.

COMMERCIAL SEED GROWING IN STATES OTHER THAN MICHIGAN.

Only a small proportion, probably not more than 5 per cent, of the commercial stock of hairy-vetch seed in the United States is produced outside of Michigan. In favorable years some localities grow more than they can use, and their surplus goes on the market. A few farmers in widely scattered communities make a regular business of growing market seed. In no other State, however, are there any hairy-vetch seed centers comparable to those in Michigan.

As far as is known at present, hairy-vetch seed can be produced commercially in any section where the crop is used. Apparently there are no localities better fitted than others for growing the seed. Further experience may show that certain soils and climates are superior or that the seed from some parts of the country is better than that from others in germination, vitality, or freedom from weeds and diseases. If such proves to be the case, these areas will become the large producers of market seed. For the present, however, the only reasons why the hairy-vetch seed industry centers in Michigan are because the plant was well known there when the demand for seed arose and because market facilities have been developed for handling the crop.

SEED GROWING IN THE NORTHERN STATES.

In the States north of Virginia the methods of growing hairy vetch for seed are practically identical with those employed in Michigan and need no further description. Hairy vetch is grown more or less in all rye-producing areas, also in orchards, truck-growing sections, and on specialized dairy farms. Some of these enterprises produce enough seed for their own use, but more do not. In some instances seed production is not profitable, either because it competes with other crops in midsummer or because hairy vetch is used only once in three or four years and it is more economical to purchase the seed. Many communities which would like to produce their own seed are hampered by lack of harvesters and thrashing machines.

SEED GROWING IN THE SOUTHERN STATES.

Seed growing in the Southern States is a more sporadic industry than in the North, although in a number of counties hairy vetch is used quite regularly for hay and green manuring. Nearly everyone who grows hairy vetch tries to save enough seed for his own use, but as knowledge of the best methods of handling the crop is not very widespread there are almost as many different practices in seed production as there are growers. In no one section are there a sufficient number of growers to give the various methods an adequate comparative trial, and it is, therefore, somewhat difficult to determine just what is the best practice to pursue. Conditions which affect seed growing apparently differ more widely than in the North, and the best practice for one locality is not necessarily the most desirable for another.

IRREGULAR CROPS IN WARM CLIMATES.

One factor that frequently interferes with seed production in the South is the tendency of the plants to "run to vine." Like many crops, hairy vetch in the South is apt to make a heavier vegetative growth and to produce less seed than in the North. Seed production is quite irregular, the crop being heavy one year and light the next, depending, apparently, upon the weather. In dry seasons and on light soils vegetative growth is not luxuriant, and the plants set a high proportion of pods, frequently yielding as much as 10 or 12 bushels of seed per acre. When the weather is warm and damp, however, especially during the blossoming period, the vines grow rank and heavy and the pods either do not form at all or do not fill. The yield may not exceed 3 pecks or a bushel, which, owing to the immense quantity of vine that must be handled, does not pay for thrashing. This condition is met less frequently in the Coastal Plain than in the Piedmont region, but it is likely to occur about one year out of three, and therefore the business of growing seed is rather precarious. Sometimes, in a wet season the seed crop is harvested from the second crop instead of the first. The first crop

is kept down by pasturing until the first blossoms appear. A mower is then run over the field to level the stand and unless the weather becomes very dry and hot a second growth of short stocky vines is sent up from the roots. These vines are quite heavily set with pods and are easily harvested. Such a seed crop is 10 days to 2 weeks later than that from the first crop, but is often of more uniform quality. The chief objection to the practice is the danger of hot weather coming before the second crop is started, killing the plants. In no case should the vetch be pastured or mowed later than the first show of blossoms, as after that the plants are unable to recover.

USE IN THE ROTATION.

Hairy vetch is sometimes grown with rye in the South, but more commonly with winter oats, which is a better hay plant and matures

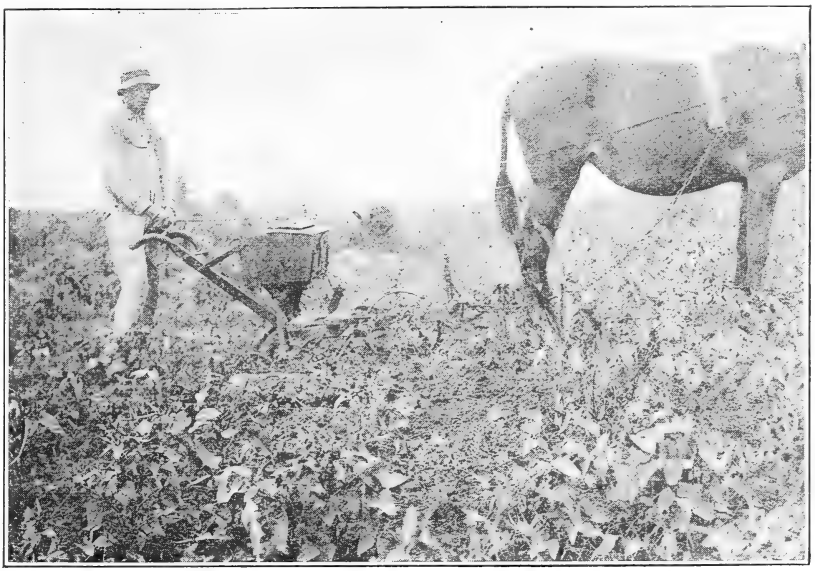

FIG. 7.—Planting hairy vetch with a 1-row drill among cowpeas in North Carolina.

more nearly with vetch. Abruzzes rye and Appler oats or other improved varieties are used quite generally by the hairy-vetch growers. In the more northern counties, barley is preferred to either oats or rye, being more winter hardy than the former and more palatable than the latter.

Because of the long growing season, the hairy-vetch seed crop fits into a greater variety of rotations in the South than in the North. Ordinarily the crop is sown in corn, cotton, or cowpeas at the last cultivation or follows directly after early potatoes, soy beans, or grain. (Fig. 7.) In many of the poorer soil areas, the hairy vetch is grown continuously until the soil has become rich enough for other crops. Cotton is especially useful to precede hairy vetch, as the

dead cotton stalks uphold the vines, yet are sufficiently decayed at harvest not to interfere with mowing. The best volunteer stands of hairy vetch are secured in corn, which does not cast as heavy a shade as cowpeas and is not worked as late as cotton.

Following the hairy-vetch seed crop there is usually time before frost for a catch crop of cowpeas, sorghum, or silage corn, or some other crop that matures in 90 days.

GROWING AND HARVESTING.

The time, rates, and methods of seeding hairy vetch in the South are practically the same as in the North, with the exception that in the South it can be seeded as late as October 1, if necessary, without danger of injury from frost.

Hairy vetch is ready to harvest for seed in the South by the latter part of June. This is a distinct advantage to the southern grower, as he thus has about three months between harvest and planting instead of a month or six weeks, as in the North. This gives him a chance to dispose of his seed without waiting an entire year and also allows more time for preparing the land for the new crop.

Hairy-vetch seed is usually harvested in the South with a mowing machine, as neither the binder nor the reaper is common there. Frequently the crop is not even mowed, but is harvested by raking the vines together with a hayrake. As they approach maturity, the plants often decay close to the ground and break away very easily. Those which do not break usually pull out by the roots, so that by raking twice, first lengthwise of the field and then across, a large portion of the vines can be gathered. Harvesting in this manner is, of course, very wasteful of seed, the loss from shattering often amounting to 30 to 50 per cent of the crop. Furthermore, the crop is very disagreeable to thrash, owing to the inevitable presence of dust and small stones. However, this method saves time and labor and reseeds the ground automatically.

MARKETING.

The supply of seed grown in the South is so small compared to the demand that practically the entire crop is sold in the immediate locality where it is grown. Except for a few isolated growers who do not have a ready market close at hand, there is rarely any difficulty in disposing of all the seed that can be grown.

If the South should become a large producer of hairy-vetch seed, some better method of marketing the crop will be developed. The small country grain elevators and feed mills which are so common in the North and which handle miscellaneous farm products of this kind are not found in most southern communities. Cotton ginners and country storekeepers are not prepared to buy and sell hairy-vetch seed, and often no other dealers are available. Consequently, a grower who has a surplus of hairy-vetch seed must find his own

market, which sometimes means shipping to a seedsman at some distant point. For this reason, if for no other, hairy-vetch seed growing is likely to be centralized at points where enough seed is produced to pay some one for handling the business.

SEED SAVING FOR HOME USE.

Hairy-vetch seed can be produced in most localities where the plant can be grown for forage and green manure. Hairy-vetch seed growing is not a specialized business to be left to certain persons who are particularly equipped for the work. Every man can grow his own seed just as he grows his own corn, potatoes, and beans. While there will always be a demand for commercial seed from those who can not obtain local seed or can not conveniently grow their own, the large growers of hairy vetch should not have to buy seed. Seed can be grown at home at a fraction of the cost of purchased seed. The chief difficulty is to do this without interfering with other farm operations. The seed does not ripen until the last of June, when other work often is pressing. Furthermore, it is usually too late to plant other crops and the seed must be grown either as a catch crop or in combination with some other enterprise.

The fitting into the rotation of a small acreage of hairy vetch for seed is a challenge to the farmer's ingenuity. Few satisfactory systems have thus far been developed, and there is no one method that can be used in all situations, owing to the variations in crop combinations possible in different localities. The chief factor to consider is the length of time the hairy vetch can be allowed to occupy the land.

On land which must be planted to other crops as early as June, hairy vetch must be removed before any of the pods are ripe. Consequently, there is no chance to save seed. Practically the only way to overcome this difficulty is to maintain a permanent seed patch in some out-of-the-way corner on the farm. Such a seed patch reseeds itself indefinitely and requires no attention except to keep the weeds pulled out and to prepare a seed bed by harrowing after harvest. A seed patch of an acre furnishes enough seed for planting about 8 acres.

A plan for growing corn and hairy-vetch seed simultaneously is being used in a few places in the South. The vetch is planted with a 3-hoe drill in strips 6 feet apart. In the spring the vacant spaces between the strips are plowed out with a turning plow or middle buster and harrowed twice with a 1-horse cultivator. Corn is planted in the rows thus provided. After the corn is planted the hairy vetch is kept pulled back from the rows until the corn plants are knee high, following which the field receives no further attention. The corn, of course, can not be cultivated, owing to the presence of the vetch between the rows. The yield of corn is quite as good as with other methods of planting in wide rows, and the lack of intertillage saves

labor. The hairy vetch is usually allowed to fall where it grows, although if a flock of sheep is available the animals are turned into the field to eat off the half-dead vines. Enough seed shatters to provide a uniform reseeding. No record is available of the use of any system of this kind in the North, but some such method might be devised.

The problem of seed saving is greatly simplified if the hairy vetch can be allowed to stand in the field until the lower three or four pods are ripe. Enough seed then shatters for replanting. If the same ground is to be reseeded the crop is mowed on a warm, dry day and handled as roughly as possible in order to shake out the loose seed before the plants leave the field. When the seed is to be saved for planting elsewhere the process is reversed; the crop is mowed in damp weather and handled gently. In the barn the hay is stored on a tight floor or on a canvas, or, better, on a shelf of 2-inch slats raised a foot or more above the floor. The hay is unloaded with a horse fork and dumped from a considerable height or is shaken vigorously by hand when storing and when removing. Frequently, a peck or two of seed sifts out of each ton of hay and is recovered from beneath the slat floor.

Hairy vetch which can be left until dead ripe can be handled easily for seed, and usually enough will shatter for reseeding. One of the most popular methods of growing seed for home use is to mow or pasture the crop early in the season and save the second crop for seed. Ordinarily the yield from the second crop is not much more than is needed for farm purposes, but it is sometimes quite heavy. When the second crop is light it usually is not harvested, but the seeds are scattered by dragging the ground with a spike-tooth harrow.

Hairy vetch which has been allowed to become overripe does not make first-quality hay and is often plowed under. By plowing 5 inches deep for several years the soil is gradually filled with seed to the depth of the furrow slice and a full reseeding is assured each year. In orchards a common practice is to turn the crop under for green manure except for the strips in the rows with the trees. These are allowed to go to seed. During the summer the cross-cultivation of the orchard drags the ripe plants over the ground and secures a fairly uniform reseeding.

HARD SEED AND LONGEVITY.

Many farm seeds, especially those of the legumes, have a hard, impervious seed coat which retards the entrance of air and moisture and delays germination. These "hard seeds," as they are called, have nothing to distinguish them from ordinary seed, yet they remain in the ground several months or even years without germinating and are a frequent cause of poor stands. Hairy vetch is especially liable to contain hard seeds, seldom containing less than 5 and often as much as 30 per cent in new seed. The percentage of

hard seed decreases with age. Hard seed is not especially objectionable where hairy vetch is grown year after year on the same ground, as these seeds will germinate during succeeding years. Where hairy vetch is used in a rotation, however, it is very desirable to have the seed germinate the same year that it is sown.

The percentage of germination of seed of different ages and the relative amount of hard seed are shown in Table III. These data are taken from germination tests made at Corvallis, Oreg., by Mr. H. A. Schoth.

TABLE III.—*Germination and hard seed of hairy-vetch seed of different ages grown in different years.*[1]

Year seed was grown.	Germination test made in October.									
	1915		1916		1917		1918		1919	
	Germination.	Hard seed.	Germination.	Hard seed.	Germination.	Hard seed.	Germination.	Hard seed.	Germination.	Hard seed.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1915	11	89	38	60	70	29	67	33	67	29
1916	.....	.....	84	16	90	10	87	13	85	12
1917	.....	.....	.....	.....	88	11	88	11	84	13
1919	.....	.....	.....	.....	.....	.....	.....	.....	82	18

[1] The germination tests were made in duplicate, using 100 seeds in each test.

The seed of hairy vetch retains its vitality for a number of years. Seed 5 years old will usually show but little, if any, deterioration.

INSECTS.

Until quite recently hairy vetch was considered almost immune from the attacks of insects and fungous diseases. One of the few insects that injure hairy vetch to any extent is the pea aphis (*Macrosiphum pisi*), which attacks the plants during the blossoming period and sucks the juices from the stems and leaves just as the seeds are setting. In wet seasons and in heavy rank growth the aphids sometimes appear in great numbers and almost destroy the vines before their presence is suspected. Fortunately, aphids cause much less damage in the thin, open stands which are the most profitable for seed production. The injury from aphids is most likely to occur on heavy soils where the crop is grown for hay. No practical means of control is known.

In the cotton belt, especially along the Atlantic coast, hairy vetch occasionally is injured seriously by the common cotton bollworm (*Chloridea obsoleta*). The invasions of this insect, when taken in time, are easily combated. They are most likely to occur during the spring months before the other host plants of the insects are available for food. Where the cotton bollworm attacks hairy vetch, the most

[5] Prepared with the advice and cooperation of W. R. Walton, Entomologist in Charge of Cereal and Forage Insect Investigations, Bureau of Entomology, United States Department of Agriculture.

useful remedy is to apply the following mixture as a spray at the earliest possible moment:

Powdered arsenate of lead	1 pound.
Water	50 gallons.

Where this poison is used at the strength specified, there is comparatively little danger of poisoning cattle. It is advisable, however, not to pasture vetch that has been sprayed with this mixture until after heavy rains have occurred.

DISEASES.

But little work has been done in the matter of identifying and determining methods of control for the diseases of hairy vetch. A leaf-spot disease (*Mycosphaerella pinodes*) attacks the leaves of hairy vetch quite frequently and does some damage. Another disease (*Protocoronospora nigricans*), which attacks the stems, leaves, and pods, has done considerable damage to hairy vetch and has been especially serious the past few years in the South Atlantic States. No control measures have been worked out for either disease.

SUMMARY.

Hairy vetch is one of the best legumes for green manuring and general soil improvement.

It is especially valuable for use in Michigan and other States bordering on the Great Lakes. It is also of value in most of the Atlantic and Gulf Coast States.

The viny character of hairy vetch makes it somewhat difficult to handle, but the high cost of seed has been the greatest handicap to its more extended use.

In the past, large quantities of hairy-vetch seed have been imported, but in more recent years this quantity has been greatly reduced. The reduction in imports, resulting in the high price of seed, has lent interest to home production.

Michigan has been the principal center for the production of hairy-vetch seed, but seed production has proved successful in practically all localities where the crop can be grown.

Hairy vetch is adapted to a wide range of soil types, but it does best on rich sandy loams.

The crop can be seeded, harvested, and thrashed with ordinary farm machinery with but little or no modification.

The seed of hairy vetch is difficult to separate from the small grains with ordinary seed separators, but the spiral separators now used in many localities successfully separate these seeds.

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